FOUNDRY TRADE JOURNAL
Established 1902
WITH WHICH IS INCORPORATED THE IRON AND STEEL TRADES JOURNAL

Vol. 74 Thursday, October 12, 1944 No. 1469

Selling Man-Hours by Weight

Since the Institute of British Foundrymen was established just 40 years ago, several of the Presidents of its Branches have in their inaugural addresses stressed the folly of selling castings by weight, but none has supplied such cogent argument as did Mr. G. R. Shotton when addressing members from the chair of the Birmingham Branch. A new point strongly emphasised by Mr. Shotton is a tendency towards the acquisition by buyers of components made as castings more cheaply by unit weight reduction, but often associated with increased manufacturing costs due to added complication. The new president does not envisage too much difficulty in convincing the production engineer as to soundness of his argument, but rightly fears lack of understanding on the part of the commercially-minded buyer. This type of individual, however, is usually quite susceptible to the clever, though not necessarily logical, appeals emanating from astute advertising specialists. Such firms would deem it an easy campaign to launch. Again, as some of the employers' associations are constantly giving attention to "Conditions of Sale," and their unification, it would not be difficult to phrase a rule covering the subject. We suggest one reading, "All castings are quoted per piece, or by quantity, and in no case will they be offered on a weight basis. The estimated weight will, however, be submitted on request for information only."

It is no more in the customer's interest than in the foundryman's to do business on this weight basis, especially when it is extended to create schedules covering a client's overall requirements. Lack of dimensional accuracy, involving extra machining or increased difficulty in assembly, may result from a desire to sell maximum weight. At one time quite a measure of progress was made in the direction of selling by piece, but we detected a reversal to the earlier practice when foundrymen became more sure of their costs through the increased interest taken in this subject. At last they knew fairly well where they stood, and why should they not oblige customers by quoting in the form the buyer liked best? Mr. Shotton has provided the answers. The buyers take advantage of the situation by lightening the castings so as to get a larger number for the same expenditure of money, and they add complications with no material increase in weight. The customers' salesmen, on the other hand, may quite often make such a virtue of decreased weight in their product as to demand an increased price for each one.

Another lesson which the buyer must learn is that the foundryman can break down a job into simple operations just as well as the engineer, but, like the engineer, he needs time to make pilot components, to modify, and plan a production line. To do this he must have a guaranteed high production and a proper allowance for jigs and tools, in the form of a master pattern, maybe dummy carrier plates for the cores, moulding machine modification and special cleaning devices. Surely for such a component, actual weight would come low down in the list of the physical properties specified in which soundness, dimensional accuracy, strength, machinability and uniformity would all take preference. The present moment is surely the most opportune for killing this ridiculous system of selling an obvious variable by weight.

CO-OPERATIVE RESEARCH

"Malleable Iron Facts," the house organ of the [American] Malleable Founders' Society in its 17th issue, announces that the Society has established its own metallurgical and testing laboratories in order to reinforce the consulting services established in 1912, which has been continued without intermission ever since. Whilst following somewhat along the lines of the British Cast Iron Research Association, this system is new to the American foundry industry.

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REMOVAL OF GASES FROM MOLTEN BRONZES

Mr. W. A. Baker and Mr. F. C. Child have drawn the following conclusions in a Paper which they submitted to the autumn meeting of the Institute of Metals.

Experiments on degassing bronzes on a scale approaching commercial practice have shown that:—

(1) Plain copper-tin bronzes can be rapidly degassed by an oxidation-reduction treatment. Several methods were successfully employed to introduce oxygen into the melt, but additions of copper oxide alone were unsatisfactory. The oxide merely formed a crust on the surface of the melt and did not transfer oxygen to the melt efficiently. The admixture of a flux with the copper oxide overcame this difficulty, and it is likely that a wide variety of flux mixtures containing copper oxide, etc., would be quite effective.

(2) The presence of phosphorus in bronzes seriously lowers the solubility of oxygen in the melt and so hinders degassing by oxidation. Copper-tin alloys containing small amounts of phosphorus, *e.g.*, up to 0.05 per cent., can be conveniently degassed by oxidation provided that the phosphorus is eliminated in the oxidation. If this is done the oxygen content can be raised to an upper limit of about 0.02 per cent. and hydrogen is then readily displaced. It is impracticable and wasteful to eliminate large amounts of phosphorus by oxidation, and copper-tin-phosphorus alloys should be degassed by scavenging treatment, *i.e.*, by treatment with an inert gas such as dry nitrogen. A five-minute treatment is sufficient, provided that the gas is blown through the metal at a rapid rate so as violently to agitate the melt.

(3) The presence of zinc has the same effect as that of phosphorus, but to a lesser degree. Alloys containing up to 0.5 per cent. zinc can be degassed rapidly by oxidation-reduction treatment, while alloys containing amounts normally found in commercial alloys, *e.g.*, 2 to 5 per cent. cannot be degassed by such treatment. An oxidising atmosphere maintained throughout melting yields melts with a low gas content, although not completely degassed. The effect of an oxidising atmosphere may be partly one of protection from gas absorption, due to oxide crusts formed on the metal surface. These alloys can be rapidly degassed by scavenging treatment with dry nitrogen, but the zinc fume and zinc loss make the process unattractive. Manganese ore charged in the bottom of the crucible is fairly effective in reducing the gas content of gunmetals, and this is probably largely due to a scavenging effect of gases liberated from the material.

The American steel foundry industry is, like the ironfoundries, so short of labour that the military lorry production programme is being jeopardised. A recruiting campaign supported by a 10-unit motorised caravan manned by war veterans has been opened at the foundry centres.

IRONFOUNDRY FUEL NEWS—XXIV

Many ironfounders should now be considering what arrangements they are to make for heating their shops during the coming winter months. A common method of heating is, of course, by means of fire-baskets, ranging in type from the normal article to the pierced bucket and the old annealing can rim. Convenient as these portable fires are, they lend themselves to abuse unless their use is strictly controlled by the management. Numbers of foundries have found that a much more satisfactory and efficient method of heating is by means of proper heating stoves. Apart from being more efficient, such stoves will generally burn coke breeze and other fuels which are sometimes difficult to dispose of otherwise.

The considerable savings which can result from control over heating methods are amply illustrated by the case of an ironfoundry on Tyneside which has come to the notice of the Ironfounding Industry Fuel Committee. This firm appointed one man to be responsible for the consumption of coke used for heating. He made a careful check on the number of fire-baskets in use and issued "rationed" quantities of coke to each basket and heating stove. He also ensured that no metallurgical coke was used for heating. The result of his appointment was that coke was saved at the rate of 335 tons a year. It will be seen that this firm could have afforded to pay this "officer i/c fire-buckets" quite an appreciable wage!

The quantity of coal and coke alone (excluding gas and electricity) used for heating the ironfoundries, and their allied departments, in Great Britain amounts to some 100,000 tons a year. Therefore, even a small percentage overall reduction will mean an appreciable contribution to the national fuel position.

FIRST-AID IN FOUNDRY ACCIDENTS

For its June meeting, the Cape Town Section of the South African Branch, presided over by Mr. L. Rowley, invited a local medical practitioner, Dr. L. F. Le Grange, to address them on the subject of first aid in foundry practice. Amongst other aids suggested was that for burns, strips of lint or gauze soaked in a solution if bicarbonate of soda (two tablespoons to one pint of water) or else hot and very strong tea. These solutions should remain on the affected part until medical attention is obtained. Tannic acid jelly, the ideal dressing for burns, should be applied all over the wound, and then covered with a sterilised dressing. The white of an egg is also to be recommended, for the albumen actually feeds as well as cools the devitalised tissues.

According to a report from the War Metallurgy Board, the post-war era will see the continued use of the 95 per cent. Pb, 2 per cent. Ag, and 3 per cent. tin for soldering, and no return will be made to the 70 per cent. Pb and 30 per cent. Sn, as it is yielding consistently better results.

SOME USEFUL WARTIME DEVELOPMENTS IN WHITEHEART MALLEABLE IRON

Foundry problems in the production of whiteheart malleable castings

By G. R. WEBSTER, A.M.I.Mech.E., A.M.I.Mar.E.

(*Continued from page* 91.)

Hardening

The wearing properties and resistance to heavy loads of whiteheart malleable cast iron can be greatly improved by suitable hardening and, in some cases, a subsequent simple tempering operation. It is, of course, very necessary to have thoroughly annealed castings before carrying out the hardening operation, as under-annealing is liable to lead to brittleness on quenching.

All the track link castings in the earlier types received a further treatment after the malleablising operation, namely, a cyanide hardening, producing a fairly hard surface of about 0.015-in. thickness with a

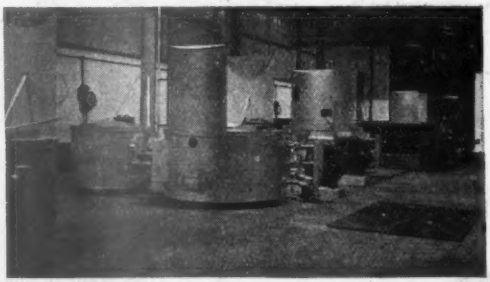

FIG. 20.—CYANIDE HARDENING FURNACE.

FIG. 21.—QUENCHING TANK FOR HARDENING LINK CASTING.

TABLE I.—*Effect of Various Heat-treatments on the Physical Properties of B.S. Test-bars.*

	Yield stress. Tons per sq. in.	Max. stress. Tons per sq. in.	Elongation. Per cent.	Bend test	V.P.N. hardness. 30-kg. load.
As annealed	16.3	26.15	9.7	180*	148
Oil quenched, 750 deg. C.	21.65	31.7	7.75	143	180
" " 750 " Temper, 450 deg. C. ..	19.4	30.6	9.5	180*	181
" " 750 " " 600 " ..	17.95	29.05	9.2	180*	158
" " 800 "	27.3	33.95	5.2	98	203
" " 800 " Temper, 450 deg. C. ..	24.7	33.7	6.00	154	201
" " 800 " " 600 " ..	22.25	32.7	7.5	180*	187
" " 850 "	28.5	36.85	6.00	100	207
" " 850 " Temper, 450 deg. C. ..	26.95	34.7	5.5	148	214
" " 850 " " 600 " ..	24.6	33.45	7.5	180*	191
" " 900 "	31.4	36.2	4.0	63	218
" " 900 " Temper, 450 deg. C. ..	30.0	37.65	5.5	64	219
" " 900 " " 600 " ..	27.1	35.95	7.2	180	210
" " 950 "	32.75	39.2	4.5	53	234
" " 950 " Temper, 450 deg. C. ..	30.6	36.5	4.00	87	218
" " 950 " " 600 " ..	27.3	34.5	5.7	180*	210

* Not broken.

toughened core. This operation was, however, quickly discontinued in favour of a straightforward oil-hardening process, the parts being heated throughout the section as quickly as possible in salt bath furnaces to 780 deg. C. quenching temperature, then quenched direct in mineral oil. Fig. 20 clearly illustrates the various furnaces and preheaters. On the wall at the left can be seen the "recording bath immersion pyrometer," each furnace having a separate instrument with a check instrument common to the department.

Quenching Tank.—In Fig. 21 are seen two tanks in the foreground. That on the left contains the mineral quenching oil with, adjacent, a circulating oil pump, pumping the oil through a water-cooled coil. The tank next to it contains hot water for removal by washing of any remaining heat-treatment salts after the oil quenching. The final testing, assembly, riveting etc., are carried out in line in a separate bay.

Testing Assembly and Riveting.—Fig. 22 shows the assembly line and the arrangement made for riveting

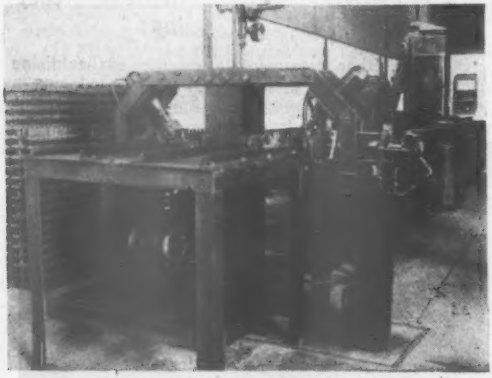

FIG. 22.—ASSEMBLY LINE FOR RIVETING OPERATIONS.

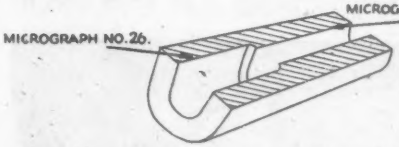

FIG. 24A.—CROSS SECTION OF TRACK LINK LUG.

shows two tracks being riveted at the same time. An air-actuated vice set at about 45 deg. holds the track firmly in position against an anvil, whilst the rivets in the chain are cold headed by the use of compressed-air hammers.

Drop-testing Machine.—Fig. 23 is a close-up of the drop-testing machine; each link is separately tested, in the assembled chain (not riveted). Guide horns are in the downward position.

Sprocket Wheel Wrap Test.—The final chains are tested over a sprocket wheel for their correct pitch. This can be seen in Fig. 24.

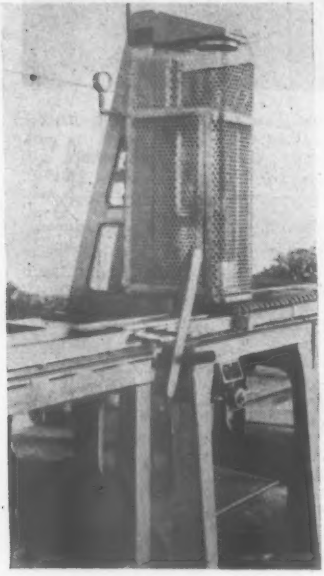

FIG. 23.—DROP TESTING MACHINE.

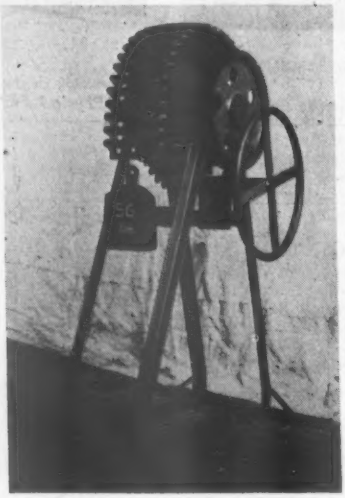

FIG. 24.—SPROCKET WHEEL WRAP TEST

Wearing Properties of Track Link Castings

In an attempt to improve the wearing properties of the track link castings, the pinholes were cast smaller than usual and then drilled out to the normal size to take the pin. The reason for this was to remove the ferritic surface layer, which is relatively unchanged by any oil-hardening process; by its removal the fine pearlite and temper carbon area is reached, which is affected by the oil-hardening process, giving a harder zone on which the hardened and ground pin can actuate. These better wearing pro-

perties have been proved in practice under severe working conditions, by a smaller pitch increase. The pitch increase is almost solely due to the pinhole wear or compression of the softish ferritic layer, particularly in the early stages of the track life.

The hardness figures in the pinholes show a marked improvement after the removal of the ferrite. The following details are given of the two micrographs (Figs. 25 and 26). Both micrographs are of the same oil-hardened sample, and are at a magnification × 60.

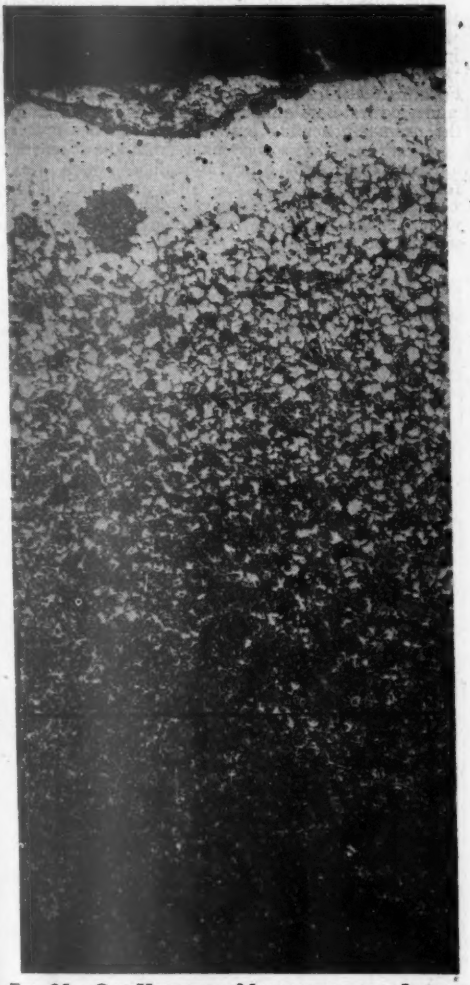

FIG. 25.—OIL HARDENED MALLEABLE FROM IRON OF FINE PEARLITE. THE ARROW POINTS TO PARTLY OXIDISED SPOTS, WHILST IN THE CENTRE THERE ARE VERY FINE PEARLITE AND FERRITE. THE LINE INDICATES FINE PEARLITE AND TEMPER CARBON. ×60.

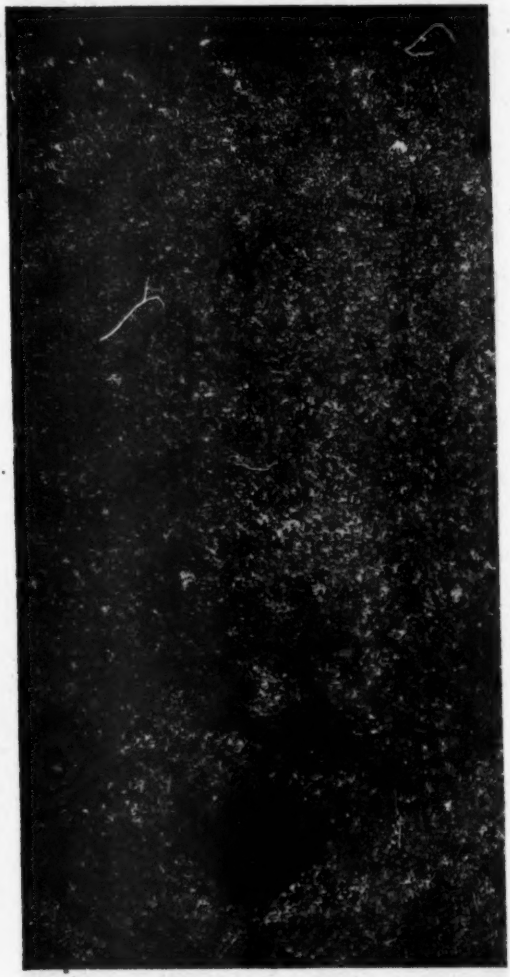

FIG. 26.—OIL HARDENED MALLEABLE TAKEN AT SECTION INDICATED BY LINE IN FIG. 25. THE TOP SHOWS A TRACE OF FERRITE, WHILST TOWARDS THE BOTTOM THERE IS VERY FINE PEARLITE AND TEMPER CARBON. × 60.

Whiteheart Malleable Iron

Fig. 25 has a core of very fine pearlite with temper carbon; the edge of the sample shows a typical decarburised zone.

The edge of the specimen in Fig. 26 corresponds to the line drawn on Fig. 25. The examination of the Fig. 26 micrograph shows about 0.075 in. metal has been removed from the original annealed skin of the micrograph (Fig. 25).

Effect of Various Heat-treatments on the Physical Properties of B.S. Test-bars

An experiment was carried out to determine the effect of various quenching temperatures, and subsequent tempering for 2 hrs. at 450 deg. C. and 600 deg. C. respectively. For this purpose, a sufficient number of B.S. tensile and bend bars were cast from the same tap of metal from the cupola, with the following analysis:—T.C, 2.86; Si, 0.56; Mn, 0.21; S, 0.189, and P, 0.061 per cent. All these test-bars were annealed together for approximately 160 hrs. at 980 deg. C. with an ore ratio of 1:5.

The annealing time of 160 hrs. is rather more than the normal commercial practice of producing a good whiteheart malleable iron, but it was thought advisable in this instance in view of the high quenching temperatures employed for the subsequent heat-treatment. For this reason the yield stress and the tensile of the annealed test-bars obtained were rather lower than with the normal annealing practice.

A carbon analysis was made from the "centre" of a $\frac{3}{4}$-in. bend bar after annealing, which was as follows:—T.C, 1.24; C.C., 0.43; and G.C, 0.81 per cent. The physical properties obtained with these various heat-treatments are shown in Table I, representing the average figures of four test-bars.

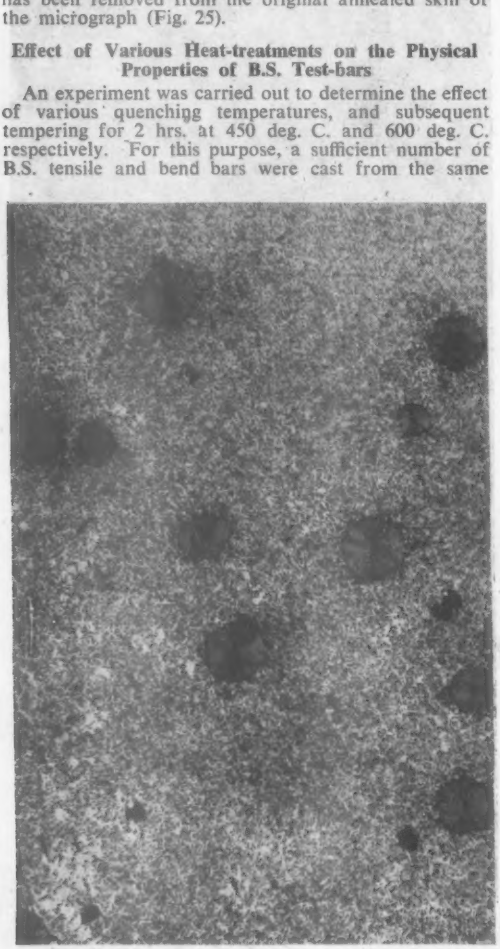

FIG. 27.—OIL QUENCHED FROM 800 DEG. C. × 60.

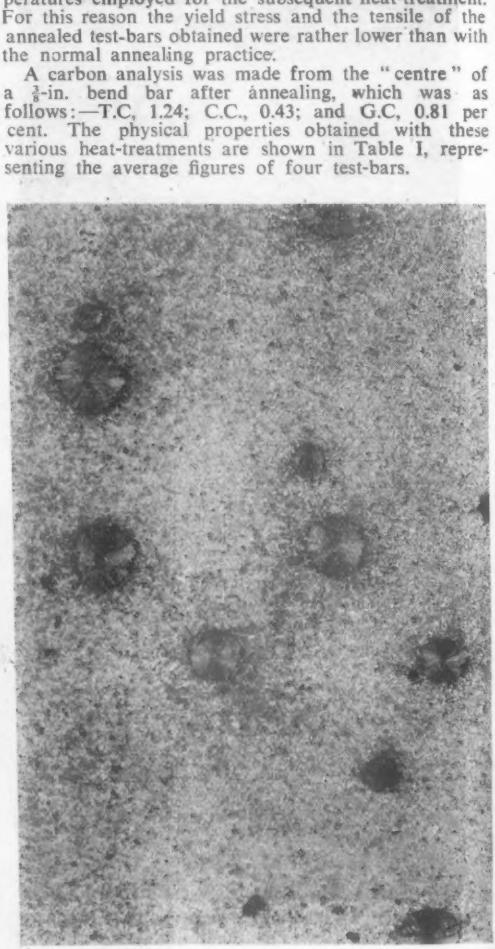

FIG. 28.—OIL QUENCHED FROM 800 DEG. C.: TEMPERED AT 450 DEG. C. × 60.

As would be expected, the quenched materials show higher tensile and yield results, with correspondingly lower elongation, and angles of bend, than the plain annealed materials. Tempering for two hrs. at 450 deg. C. and 600 deg. C. caused a gradual drop in the tensile and yield stresses, and a corresponding increase in elongation and angle of bend. The Vickers Pyramid hardness figures were obtained with a load of 30 kg. and taken in the centre of the bend test-bars. In view of the very well annealed material, the hardness figures have not increased considerably at the higher oil-quenched temperatures, which would be expected with the normal commercial whiteheart malleable iron.

The physical properties obtained in these experiments show very clearly the great possibilities for the use of malleablised and oil quenched whiteheart malleable iron. All the quenched and tempered samples showed a soft decarburised outer rim of about the same thick-

(*Continued overleaf, column* 1.)

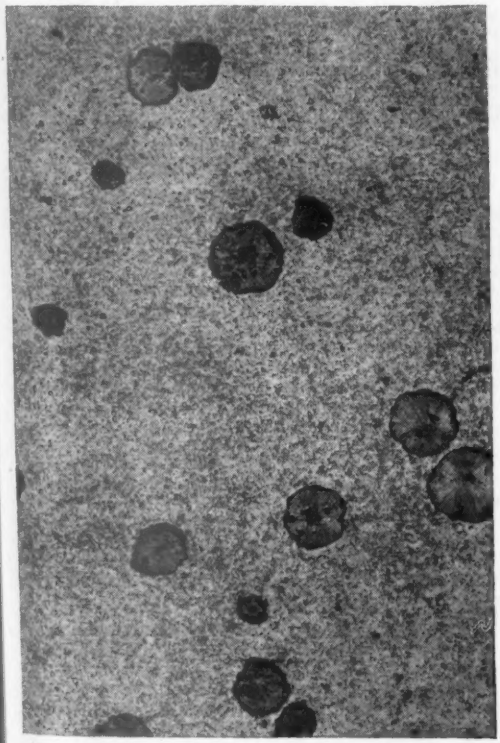

FIG. 29.—OIL QUENCHED FROM 800 DEG. C.; TEMPERED AT 600 DEG. C. × 60.

FIG. 30.—OIL QUENCHED FROM 800 DEG. C. × 1,500.

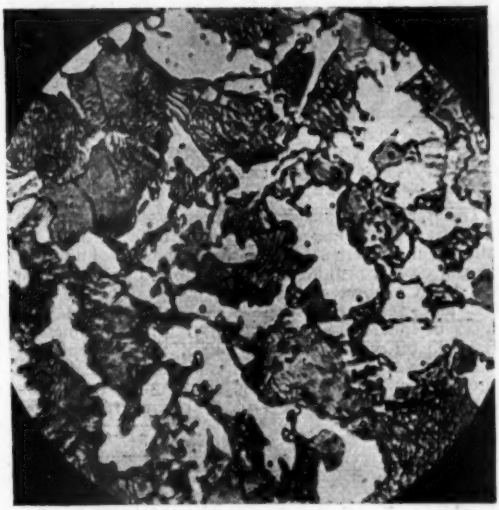

FIG. 31.—OIL QUENCHED FROM 800 DEG. C.; TEMPERED AT 450. × 1,500.

SOME USEFUL WARTIME DEVELOPMENTS IN WHITEHEART MALLEABLE IRON

(*Continued from previous page.*)

ness as that in the plain annealed material, thus the various heat-treatments had no effect on the skin of the casting, it consisting of soft ferrite, irrespective of the heat-treatment. Figs. 27 to 29 show micrographs × 60 of hardened specimens; Fig. 27 being oil-quenched at 800 deg. C.; Fig. 28 oil-quenched at 800 deg. C. and tempered at 450 deg. C.; Fig. 29 oil-quenched at 800 deg. C. and tempered at 600 deg. C.

FIG. 32.—OIL QUENCHED FROM 800 DEG. C.; TEMPERED AT 600 DEG. C. × 1,500.

The same specimens have been used to produce micrographs at a magnification of × 1,500, with an oil immersion objective to give maximum resolution of the eutectoid constituent. The sample quenched from 800 deg. C. shows very fine lamellar pearlite (sorbite). The tempered samples show similar structures with traces of spheroidisation. Fig. 30, at 1,500 diameters, has been oil quenched at 800 deg. C.; Fig. 31, also at × 1,500, was oil quenched at 800 deg. C. and tempered at 450 deg. C.; and Fig. 32, again at 1,500, was oil quenched at 800 deg. C. and tempered at 600 deg. C.

(*To be continued.*)

It is stated in the American Press that 49,000 tons of cornflour and dextrine were used annually for the production of ferrous and non-ferrous castings.

BRUSH FOREMEN'S ASSOCIATION

The Foremen's Association of the Brush Electrical Engineering Company, Limited, held its second annual conference at the company's works in Loughborough recently, when, in addition to Brush foremen, the delegates, numbering over 150, represented several important industrial concerns throughout the country. Mr. Alan P. Good, managing director of the company, presided at the dinner on the first evening. Sir Frederick Leggett, C.B., Deputy Secretary of the Ministry of Labour and National Service, was the guest speaker at the dinner.

During the various sessions addresses upon the following subjects were delivered to the delegates:—"Economic Aspects of Post-war Employment Policy," by Dr. Maurice Dobb, lecturer in economics at Cambridge University; "Post-war Developments in Joint Consultation," by Mr. L. H. Pearmaine, National Secretary of the Transport and General Workers' Union; "The Formation of a National Institute of Foremen," by F. J. Burns Morton, works manager, Sketchley Dyeworks, Hinckley (with discussion); "The Philosophy of Management," by Dr. J. A. Bowie, in charge of Research on Personnel Administration; "From Hospital to Industry," by Group Captain C. J. S. O'Malley, C.B.E., M.B., B.S., of the Royal Air Force Rehabilitation Unit, Loughborough.

PUBLICATION RECEIVED

Recommended Technique for Making Fillet Welds in the Downhand, Vertical and Overhead Positions. Published by the Welding Research Council, The Institute of Welding, 2, Buckingham Palace Gardens, London, S.W.1.

This memorandum, presented as an 8-page booklet, has been prepared for the Welding Research Council by the F.E.5 Committee on Arc Welding Procedure for Shipbuilding. The recommendations have, in general, been reduced to tabular form, giving information as to the number of runs, the electrode size, run length, and the amperage of the current to be used.

CORRESPONDENCE

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

FOUNDRY FLOORS

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—We would be obliged for any advice or information upon suitable flooring for a grey-iron fettling shop handling castings from a few ounces to 3 tons, with the usual fettling-shop equipment.—Yours, etc.,

"ABRASIVE."

Statistics for the first half year show that American production of malleable iron castings was slightly greater at 440,478 short tons than in the first six months of 1943. Forward bookings, however, are much higher.

THE DEVELOPMENT AND PRODUCTION OF INOCULATED CAST IRON

By H. P. HUGHES and W. SPENCELEY

Discussion on a Paper presented at the annual conference of the Institute of British Foundrymen. The President, Mr. J. W. Gardom, occupied the chair. The Paper was printed in our issues of August 24, August 31, and September 7.

MR. H. J. YOUNG (Member) said that in 1932 before the Institute of Marine Engineers he said: "The form of the graphite and the extent of elongation, of continuity, and of parallelism appear to be those factors governing the influence of any given amount of free carbon upon the physical properties of grey iron of any one composition." In that same Paper are shown a number of half-plate studies of graphite at 75-diameters magnification giving the strength, the thickness of section and the weight of the castings concerned. He still preferred his old definition, as given above, to the description "random," which to his mind meant nothing that is determinable and, therefore, is itself random. He thought that such terms should be omitted from scientific nomenclature.

The Authors state that rosetted structure was undesirable because "of lack of continuity throughout." This appeared to be a misstatement, as good cast irons often contained graphite which lacked continuity throughout, indeed, he could not recall an exception. This Paper compared an ordinary cast iron (see Table II) with a semi-steel which was inoculated; he (Mr. Young) thought it would have been simpler if a semi-steel uninoculated had been compared with the same semi-steel inoculated. The above comments were no condemnation. The Authors were obviously young and very enthusiastic. He had already offered them any help which his experience might be to them. They claimed to have discovered that certain castings made with their original iron distort, but not when made with their new iron. This was highly interesting, and he suggested that they pursued this phenomenon by itself. He awaited their next Paper with interest.

MR. A. E. MCRAE SMITH, M.A. (Member), congratulated the Authors because they had given a very good description of a change-over of methods in their own foundry, and many members of the Institute could derive a great deal of benefit from that description. For once he disagreed with Mr. Young. He did not think there was any question of proving how much better an inoculated iron could be, or what would be the difference if they used the same amounts of steel scrap and low-phosphorus iron without inoculation. They had proved that, by changing to steel mix cast iron with late silicon additions, they had obtained a material giving very much greater latitude, so that it could be used in both light and heavy sectioned castings with equally good results. He asked for added detail as to the minimum and maximum sectional thicknesses in which they had obtained satisfactory close-grained castings, using the same mixture.

Recently he had had the opportunity of seeing the Authors' foundry at Rochdale, where they were doing an excellent job and were producing very good castings. In their Paper they had given information to the industry in a very plain and straightforward manner, without any super-academic discussion of the whys and wherefores. The single-blow impact value of the inoculated steel mix cast iron showed very well compared with a common phosphoric iron. He asked whether these tests were made on the old-type Avery machine, or on the new type with modified grips.

Tensile Test Tolerances

MR. P. A. RUSSELL, B.Sc. (Member), whilst welcoming the Paper as being excellent, said that its one fault, as already pointed out by Mr. Young, was that so much of the comparison was made between two irons which were in no way related to each other. He would have preferred to have seen figures relating to the iron as melted plus and minus the inoculant; such figures would have given still more useful data.

On the other hand, he joined issue with Mr. Young in regard to the suggestion that the second metal in Table II was a nice ordinary semi-steel which anybody could use without bothering to inoculate it. The most important factor in the Paper was that it brought to notice—perhaps not for the first time, but it served to rub it in—the importance of graphite distribution. Comparison of Figs. 4 and 6 (showing the structures of a low-carbon cast iron, with its dendritic or grain boundary effect, and of a medium-carbon iron, with its graphite in a random and flaky distribution) served to emphasise the point. Much of the old semi-steel had been given a bad name due to the fact that it had the structure shown in Fig. 4. The opinion had often been expressed that semi-steel was more brittle than ordinary cast iron; and Mr. Russell believed that it was when it had the sort of structure shown in Fig. 4. The use of a small late silicon addition—and he preferred that term to the word "inoculant"—was very valuable in any iron of reasonably low carbon content, even if it were only of the order of 0.1 per cent.

With regard to Fig. 10, showing the comparative mechanical properties of ordinary and inoculated cupola metal, Mr. Russell said that, although he did not like it because it compared two irons which were not in the same family, he congratulated the Authors on their showing of the variations. He could hardly credit the smoothness of the curves shown in the previous Paper, by Mr. Barnes and Mr. Hicks; but Fig. 10 in the Paper by Mr. Hughes and Mr. Spenceley did show normal variations such as would be obtained in routine testing.

Finally, on the question of tolerances in tensile testing, Mr. Russell said he had heard claims from time to time that certain treatments would increase tensile strength by amounts such as a quarter of a ton. He urged, however, that no notice should be taken

of increases in tensile strength in cast iron of less than 1 ton, for there were far too many variables entering into it; small variations should be regarded with very great caution before attaching any value to them.

Authors' Reply

MR. HUGHES said it was a pity Mr. Young disagreed with the terms used; unfortunately, they had not adopted standard terms to express some of the more modern theories, and accordingly the variations in expression now in use lead in many instances to a wrong understanding of the subject. Replying to the criticism in the comparison of two irons on the ground that they were not in the same family, this might not be so, but they had been used for the same type of work, which no doubt gave adequate reason for such comparisons. Also the Paper was partly the result of necessity and partly an attempt to increase knowledge of the modern technique required in the production of cast iron. The Paper did not give a comparison of the properties of the inoculated iron with those of the uninoculated, though they had been made. The point which it was desired to emphasise was that iron which had been made on a production basis had qualities much superior to those of the iron used originally. These figures might have been useful to Mr. Young and Mr. Russell, but the Authors thought there was no point in including figures that had little practical value, as the metal was not used in this condition.

Although some criticism had been directed to the analysis of the two irons as given in Table II, there was not such a big variation between them, only 0.25 per cent. in respect of carbon and 0.17 per cent. in respect of phosphorus, so that in many respects the conditions were favourable for comparison. The mixtures used varied only to the extent that in one of them 10 to 15 per cent. of steel was used in place of what was originally machinery scrap. One of the main objects of the work discussed in this Paper was to relieve distortion in the machine shop, and they had gone a long way towards achieving that object, as shown by the results to date. Since the Paper was written, the trouble had been reduced considerably, and the improved metal had been accepted with much favour in the machine shop.

After commenting that he was not familiar with the Meehanite Corporation's patent, to which Mr. Young had referred, though he was familiar with certain aspects of the Meehanite process, Mr. Hughes said that one reason why it was necessary to increase the late silicon additions in some cases was that often very thin sections had to be cast. As to Mr. Russell's remarks on tensile strength, the results in the Paper clearly indicated that the variation in this case was very much greater than 1 ton. Finally, in reply to Mr. McRae Smith, he said the impact testing machine used was of the new type with the most modern grips.

MR. SPENCELEY, replying to Mr. McRae Smith's question concerning the variety of sections of castings made in the Authors' foundry, said one could get a fair idea of the range of castings made from the illustrated figures. In particular, Fig. 24 illustrated some of the small thin castings which in five cases were of thicknesses between $\frac{3}{16}$ and $\frac{5}{16}$ in.; the bottom casting, an air duct for a reconditioning plant, was $\frac{3}{16}$ in. thick, 24 in. long and 8 in. deep, weighing approximately 14 lbs. The complicated casting in the centre of the bottom row was $\frac{5}{16}$ in. thick and the remaining three castings $\frac{1}{4}$ in. thick. The castings in Fig. 25 represented an average variety of the smaller solid type, and the extensive deep machining necessary. In addition a large variety of castings was made, following the lines of the A, B and C as illustrated at the bottom of Fig. 23, some of a smaller nature and others much larger. All this variety of sections was cast in the same mixture.

Written Discussion

MR. J. L. FRANCIS, A.M.I.Mech.E. (Member), wrote: Concerning the Authors' remarks on the size and type of inoculating material to give the best results, it seemed certain that no one type or quantity could be the best in all circumstances. Factors that must be taken into account are the kind of melting technique and composition of the charges, the quality and quantity of the coke used, together with the metal section of the castings. All these items had an important bearing on the quantity and kind of inoculant for giving the optimum results. It appeared generally that the harder low carbon type irons required heavier inoculation than softer irons cast in the same section. The Authors had confined themselves to the use of graphitising type inoculants in conjunction with low carbon equivalent irons. From the work already done on the subject it was apparent that there was also a field of usefulness for the stabilising type of inoculant which contained a balanced proportion of carbide stabilising ingredients, such for example as chromium, molybdenum, manganese, etc. These found application with the high carbon equivalent irons where the material without treatment would be lacking in density, hardness or strength.

The Reply

The AUTHORS wrote that they agreed with Mr. Francis that different types of inoculants were suitable for different conditions, this being referred to in the Paper. The unsuitability of either carbon electrode or calcium silicide for their particular practice was given. With the present information available to the Authors—and this was the result of tests on a variety of inoculants—it was claimed that ferro-silicon of the quality and size stated gave the most satisfactory results. They agreed with Mr. Francis that there was also a wide field of usefulness for the stabilised type of inoculant. This type would, of course, require more attention to section of casting.

SPEED OF ROTATION IN THE CENTRIFUGAL CASTING PROCESS

Review of conditions of rotational speed in various types of centrifugal casting processes

By J. E. HURST, D.Met.

(*Continued from page 99.*)

True Centrifugal Castings, Vertical Axis

Spinning about the vertical axis is usually adopted for the production of castings of large radial thicknesses in comparison with the length, and in those cases where the length "H" (Fig. 3) is small in comparison with the diameter. The Billand process,[14] proposed in Germany for the production of cast-iron pipe by spinning about the vertical axis by virtue of the special pouring arrangement adopted, may more properly be considered as a special case of the Lavaud-Briede type of casting process.

In the Wasson process for the production of individually cast piston rings using built-up sand moulds spinning was operated at speeds calculated to give a constant centrifugal pressure of 100 lbs. per sq. in. The principle of arranging the rotational speeds to provide for a minimum centrifugal pressure in accordance with the diameter and radial wall thickness of the castings was adopted in the process designed by the firm of David Brown. In the description of this process given by Rowe,[15] the speeds were arranged to give a minimum pressure of 45 lbs. per sq. in. and over the range of castings this was provided for by speeds of 450 to 950 r.p.m. Another application of vertical spinning processes to the production of bronze gear wheel blanks is described by Stockton.[16] A speed of at least 700 r.p.m. is recommended for castings having an outside diameter of 12 in. This is equivalent to a peripheral speed of 2,100 ft. per min. A constant peripheral speed of at least this order is recommended, it being stated that speeds in excess of this are in use.

An adaptation of the vertical centrifugal casting process to the production of bi-metal chilled rolls described by Hundt and Weber[17] allowed of the introduction of the first type of molten metal into the rotating chill mould rotating at a sufficiently high speed. Following upon the introduction of the second metal into the hollow core, the rotational speed was reduced to a value low enough to retain the body of the roll solid and a paraboloid depression in the head only. In the case of a roll 600 mm. dia. and a body length of 1,000 mm., an initial speed of 800 r.p.m. was necessary. Upon pouring the core, the speed was reduced and brought to a final speed of 200 r.p.m.

An inclined axis of rotation is adopted in a machine described by Zaiser.[18] This machine is constructed to be capable of rotating at speeds of from 50 to 3,000 r.p.m., and as it is intended to operate with a variety of non-ferrous alloys, precise rotation speeds are not given, it being recommended that these be determined by experiment.

The taper in the vertical bore of castings produced in this manner can be used to determine the rotational speed. By establishing the permissible taper it is possible in any given casting to calculate the speed of rotation from the relationships given in equation (1) and (2) above. Experience agrees that such calculated speeds are in general not sufficiently high. The type of metal poured, its viscosity, pouring temperature, the temperature and character of the mould and its surface are some of the factors which operate and cause a deviation from the theoretical relationship. In general the actual taper is somewhat greater than that calculated. Operating with non-ferrous alloys (bronzes), Zuehlke[19] records his experience that speeds must be increased to a point where centrifugal force is about 100 times that of gravity and on this basis derives the relationship

$$N = \frac{2655}{\sqrt{D}}$$

where N is the speed in revolutions per minute and D the diameter of the casting in inches. The curves plotted in Fig. 5 show this relationship and for 200

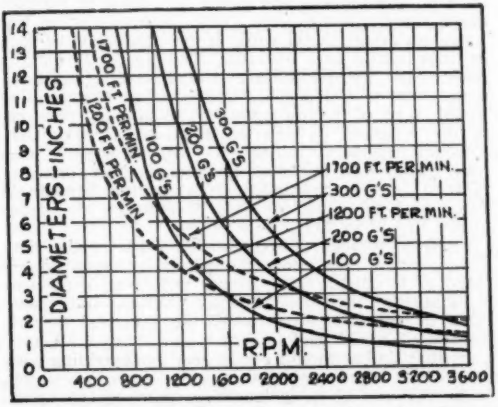

FIG. 5.—SHOWS THE RELATIONSHIP BETWEEN ROTATIONAL SPEED AND CASTING DIAMETERS FOR THIN SECTIONED WORK.

Centrifugal Casting Process

and 300 times that of gravity in addition for varying casting diameters. It is intended that this relationship should be used for thin walled castings only, where the difference between the outside and inside diameters is not too great. For instance, if a casting requires a finished bore of 2 in., a speed of 1,900 r.p.m. would be chosen; but if this casting had a flange 6 in. dia., it would be necessary in the interests of safety to drop to lower speeds, even if this resulted in greater taper in the bore. The same diagram (Fig. 5) enables a comparison to be made between this relation and the alternative of a constant peripheral speed at either 1,700 or 1,200 ft. per min. The differences are substantial and the Author, whilst agreeing that speed variations of the order of 10 per cent. or thereabouts are unimportant, states that by operating as close to 100 g. as is practical, they have obtained their best results and that operating at speeds greater than 100 g., no improvements have been obtained.

Janco[20] records his findings that in actual practice the amount of taper in the bore of the casting cannot be reduced materially by rotating at speeds of over 1,500 ft. per min. These speeds are somewhat lower than the 100 g. relationship above. In the production of thick heavy slush pump liner castings 8½ dia., Falk[21] records that a speed of 600 r.p.m. (1,340 f.p.m.) was used. It was stated also that higher speeds were used formerly, but the lower speeds were found better, are giving a longer mould life.

True Centrifugal Casting, Horizontal Axis

The Author has previously given a minimum speed condition of 1,200 ft. per min. peripheral velocity as being used in the production of cylindrical castings such as cylinder liner and piston ring drum by rotation about the horizontal axis. This recommendation was based on experimental work in the production of such castings in cast iron operating with hot cast-iron dies having an internal surface temperature of approximately 550 to 600 deg. C., and pouring with a tilting trough type of pourer spout. The guiding principle in the adoption of this value as an approximately constant peripheral velocity was the securing of uniform radial wall thickness or internal bore diameter rather than the achievement of a constant centrifugal force over the range of sizes of castings, *viz.*, from about 3 to 12 in. O.D.

From a number of experiments made at the time it was found that under the particular conditions, a speed of less than 1,000 ft. per min. was insufficient to accelerate the metal quickly enough, and above 1,200 ft. per min. little further improvement in uniformity of radial wall thickness was secured. Under somewhat similar mould conditions, but operating with the helical edged type pourer spout pouring castings 36 in. dia. and 12 ft. in length, a speed of 166 r.p.m. was found to be necessary uniformly to accelerate the molten metal and to obtain satisfactory dimensions. This corresponds to a peripheral velocity of 1,500 ft. per min.

For sand lined moulds in the Moore sand spun process, Donoho[22] recommends the general rule propounded by Cammen (*loc. cit.*) to use a spinning speed which will give a centrifugal force of about 75 times gravity. A simple formula is:—

$$N = \frac{1675}{\sqrt{R}}$$

Where N = r.p.m. and R the radius of the casting in inches. A casting of 6 in. dia. will require a spinning speed of 967 r.p.m., or for a 12 in. dia. casting the speed will be 684 r.p.m. The records of the casting of 30 in. dia. pipe at Acipco by this process record a speed of 403 r.p.m., coinciding approximately with the above formula. The above speeds respectively correspond to peripheral velocities of approximately 1,500, 2,150 and 3,200 ft. per min. These values refer to the Sand Spun process, in which the sand lined mould is continuously rotated about the horizontal axis and the molten metal fed to the rotating mould by means of a pourer spout.

It is recognised that in metal mould spinning the speeds used may be somewhat lower since the enhanced cooling effect of the mould causes the metal to pick up more readily than in a refractory mould. For very thick castings in sand lined moulds the initial spinning speed is often slightly increased beyond that calculated from the above formula in order to pick up the large volume of metal quickly. For castings such as flanged castings, where the maximum outside diameter is very much greater than the inside diameter, the spinning speed may be a compromise so as to obtain a sufficiently high force on the inside diameter and yet not excessive on the maximum outside diameter. Excessively high spinning speeds will tend to cause longitudinal hot tears by reason of the stress developed by the centrifugal force as the casting freezes and shrinks away from the mould wall.

The production of cast-iron soil pipe by spinning in sand-lined moulds rotated about the horizontal axis has been described by Farr.[23] In this process a 4 in. dia. standard pipe is produced at a speed of 750 r.p.m. This is equivalent to a rotational velocity of approximately 750 ft. per min.—a speed substantially lower than recommended by Donoho. It is stated that this speed gives an acting centrifugal force of about 1½ lbs. per sq. in. Soil pipe is substantially thinner than cast-iron socket pipe, and the standard U.S.A. thickness for the three grades of Standard, Medium and Extra heavy are ⅛, $\frac{7}{16}$ and ¼ in. The 4-in. pipe described has a total weight of 32 lbs. It is probable that the comparatively rapid rate of solidification of such pipe, even in sand moulds, and the small volume of metal necessary to accelerate, makes it unnecessary to use higher speeds of rotation. In a description of the Sand-Spun process by Moldenke[24] a slightly different formula from the above is given, *viz.*, $N = \frac{1,550}{\sqrt{R}}$ where R equals the inside radius in inches.

Experience in the casting of various non-ferrous alloys by rotation about the horizontal axis has been recorded by various investigators and references to rotational speeds adopted are available. Chester Clark

(*ibid*), in casting cupro-nickel shell bands 14 in. dia. (whether internal or external is not stated), used a speed of 1,050 r.p.m., corresponding to an approximate peripheral velocity of 3,850 ft. per min. Dreher,[25] in the casting of aluminium bronze, recommends a high speed achieving pressures of the order of 66 lbs. per sq. in., and Meckel,[26] in the casting of white metal bearings, has found the following relation between speed of rotation and bearing diameter to give satisfactory results, *viz.*, $N = \frac{1,600}{\sqrt{R}}$ where R equals the radius of the bearing in centimetres. In the casting of Monel metal using metal moulds and a spout type pourer with mould temperatures of the order of from 300 to 450 deg. C., the Author has obtained generally satisfactory results with speeds corresponding approximately to a peripheral velocity of 1,200 ft. per min.

In the centrifugal casting of steel, Cammen (*ibid*) recommends speeds determined by the relationship previously mentioned. In a later Paper[27] on the same subject he proposes a slightly different relation. $N = \frac{1,750}{\sqrt{R}}$ where R is the radius of the casting in inches. For the casting of tubes of small diameter and also small thickness, or for diameters larger than 7 in. and practically any thickness, this formula may be employed. Where the thickness of the tube is material, the inside radius should be used for purposes of calculation. These recommendations are concerned with the spinning of steel in hot metal moulds. The production of cylinder barrels for aircraft engines in steel mould at Ford's is operated at peripheral speeds of 1,000 to 1,750 ft. per min., calculated on outside diameter of casting.[28] In his process for the casting of steel tyre blanks, McConway[28] operated his machine at a peripheral velocity of approximately 65 ft. per sec. (3,900 ft. per min.). For an outside diameter of tyre blank of 30 in. this equals a speed of rotation of 1,560 r.p.m. This high speed was probably determined by the large volume of metal required in tyre blank castings. Earlier workers in this field of centrifugally casting steel ingots recommended a high speed of rotation, as for example Carney,[29] who recommends a peripheral speed of 3,000 ft. per min.

The very great importance and relationship of the pouring conditions to the speed of rotation are recognised by the firm of John Brown[30] *et aliter* in their British patent relating to a process for the production of large drums in steel. In this machine a reciprocating type pourer spout was used and it is recorded that the speed of rotation of the mould is dependent upon the diameter of the mould and the rate of flow of metal. In an example of a steel drum casting, 50 in. dia., a rotational speed of 220 r.p.m. is recommended for conditions of molten metal delivery at the rate of 78 cwts. in 102 secs. Incidentally, this metal was introduced through a pourer spout with five 1¼-in. dia. nozzles. The above speed corresponds to a peripheral velocity of approximately 2,900 ft. per min. and the pouring rate 1 cwt. in 1.31 secs., or 86 lbs. per sec., approximately.

In the Lavaud process for the production of cast-iron pipe, the relationship between rotational speed and the pouring conditions are completely interdependent. Water-cooled metal moulds are used, arranged to rotate about an axis slightly inclined to the horizontal and molten metal is introduced to the rotating mould in the form of a stream of narrow width issuing from the end of a stationary pouring trough the full length of the mould. When these conditions are established, the rotating mould of the order of 20 ft. in length is allowed to move in a direction parallel to and away from the end of the pourer spout. In this manner, and by reason of the relative longitudinal movement between the mould and metal stream, the whole rotating surface of the mould is covered with molten metal. In this arrangement it will be appreciated that, operating with a mould of given outside diameter, the uniform radial wall thickness or internal diameter of the casting required will be determined by the quantity of metal flow, the width of the metal stream, the rate of longitudinal travel of the mould and its speed of rotation. For a given rate of metal flow and stream width it becomes necessary to synchronise the longitudinal movement and the speed of rotation of the mould.

The investigations of Dr. Pardun[31] on a machine of this type producing castings 17 ft. in length, 12 in. internal diameter and 0.5 in. radial wall thickness, showed a minimum speed of 400 r.p.m. (1,260 ft. per min.) to be necessary to eliminate spiral markings from the surface of the castings. These spiral markings are due principally to the relation between the lead in the longitudinal traverse of the metal stream and the speed of rotation and a critical speed can be regarded as that at which one revolution is completed in the time taken for the longitudinal travel to equal the stream width. Under the conditions of Pardun's experiment, the above speed was considered to be the critical, and a speed in excess of this was necessary to ensure overlap of the deposited metal stream and the elimination of the spiral markings.

In these same investigations, Pardun also found that the minimum speed at which molten iron failed to be picked up was 240 r.p.m., or 753 ft. per min. These experiments all relate to cast iron using water-cooled metal moulds as in the Lavaud system. The area of the mould surface in the production of large diameter castings is such as to present a large amount of mould surface to be covered with liquid metal. According to the quantity of metal delivered by the particular pouring device adopted and its rate of acceleration, it will be appreciated that the initial layers of molten metal can be extremely thin. These circumstances frequently account for surface defects. They can be avoided by the adjustment of the speed to enable substantial quantities of metal to be accelerated. An alternative method is to begin pouring with the mould at rest until enough metal has been introduced to provide a thick enough initial layer, after which the mould can be rotated and brought up to the desired speed.

Centrifugal Casting Process

Semi-Centrifugal Castings and Pressure Castings

The machines designed for the operation of the semi-centrifugal and pressure casting processes for the most part rely on the use of sand moulds, and in general operate at somewhat lower speeds than those already described. The process adopted by the Ford Company in America as described[32] may be regarded as within the category of semi-centrifugal processes. This process for the production of gear-wheel blanks for motor lorries at first operated at speeds of from 400 to 1,800 r.p.m. Later it was found that speeds of 600 to 800 r.p.m. proved just as satisfactory. Operation began with these higher speeds, but later it was found that the lower speeds gave the best results with the minimum strain on the machines. In the description referred to, what is described as the truck ring gear is spun at 190 r.p.m. and the smaller car ring blank at 325 r.p.m. In the case of the transmission cluster gear, with its still smaller perimeter, a speed of 400 r.p.m. is adopted.

A number of processes operating in America utilise machines covering speed ranges from 50 to 450 r.p.m In some cases the technique of centrifuging after filling the mould has been developed, and speeds of rotation are so controlled as to give peripheral speeds of between 450 to 600 ft. per min. In one example quoted, gear blanks averaging 24 in. dia. are produced at a rotational speed of 92 r.p.m. An example of pressure casting operating at the Wehr Steel Company has been described.[34]. Cluster type moulds are cast made up in cores assembled in flasks about 20 to 30 in. dia. Rotated about the vertical axis the average spinning speeds vary according to the type of casting from 154 to 250 r.p.m. The adaptation of the centrifugal process to the casting of jewellery in low melting point alloys using rubber moulds as recently described[35] is a form of pressure casting. In these processes peripheral velocities are used of 3,600 ft. per min., calculated on the maximum diameter of the mould cavities about the axis of rotation.

Summary

The Author has attempted to review the conditions of rotational speed adopted in the various types of centrifugal casting processes which have been proposed or adopted commercially. It is evident that in each type of process differences exist in the speed conditions adopted by individual operators. In spite of these, at least two notions of principle governing the speed conditions exist, running through the whole of the records and recommendations.

The first, and perhaps the earliest, notion is that of the choice of a speed to obtain an approximately constant condition of tangential or centrifugal force during rotation. The predetermined conditions of tangential force recommended have been fixed somewhat arbitrarily, but in general based upon practical experiment. They are variously expressed as indicated in the Paper, and under these conditions it will be appreciated that the peripheral velocity will vary with the diameter of the castings. The density of the molten metal is also a factor in these considerations.

An alternative notion is that of the choice of a speed of rotation to conform to a uniform predetermined peripheral velocity. Here again the predetermined velocity has been based upon practical experiment and has been governed by some such consideration as the uniformity in radial wall thickness or by some relationship to the pouring considerations. The rotational speed, in that it plays an important part in the acceleration of the molten metal delivered to the mould, depends very frequently on the method and conditions of pouring, the nature of the mould and the characteristics of the liquid metal. It is such considerations which account for many of the differences in speed conditions adopted by individual processes. In the case of true centrifugal casting about the vertical axis, a substantial increase in the theoretical speed calculated to give a required internal form in bronzes has been found necessary. The differences in speed requirements consequent upon the use of metal moulds as opposed to sand moulds in rotation about the horizontal axis has been observed, and attention has been drawn to the interconnection between the conditions of pouring in so far as velocity, rate and direction are concerned and speed of rotation. In the case of semi-centrifugal and pressure castings, in general, lower speeds of rotation are used. In these cases the characteristics of the mould are of considerable importance in determining the maximum speed that can be adopted with safety.

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The July-August issue of "Foundry Practice," the house organ of Foundry Services, Limited, of Long Acre, Nechells, Birmingham, 7, contains an elementary article on crucible steel melting; the Canadian Report on Test-bars for Brass and Bronze, and a description of a heavy-duty truck of novel construction. Designed for handling castings and the like, the truck is furnished with three wheels of the caterpillar type, so that awkward and uneven ground can be traversed. It is made by W. H. Ferris & Company. Finally there is an article on moulding gear wheels.

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NOTES FROM THE BRANCHES

Newcastle-upon-Tyne.—This branch opened the 1944-45 session with a successful meeting on September 30. Some 50 members were present, Mr. E. B. Ellis, Branch-President, presiding. Mr. Ellis welcomed the members and said that this was the first meeting for nearly four years, but he did not think there was any reason for reproach at this state of affairs. He believed it was correct to say that in the Tyneside area, as in all other parts of the country, the first consideration had been to put major efforts into providing the tools to finish the job on which the country started in September, 1939. In between the tool making, the small amount of spare time available had equally unremittingly been given to help to win the war in various ways.

Since the outbreak of war there had been some changes in membership, and the comparative figures may be of interest. These figures showed a decrease in membership of about 40 members covering all sections. One member firm had resigned, but three others had been enrolled. They were:—George Blair & Company, and their associated company; Washington Steel Foundries, Limited; and Jarrow Metal Industries, Limited. These would undoubtedly strengthen the branch. There was every indication that the branch would enrol a number of new members in the near future, and the honorary secretary already had the names of several persons who had expressed interest. He was pleased to see there were present a number of members new to Newcastle who had either transferred to the branch or had joined the branch since the last meeting.

Mr. Ellis then dwelt on the activities of the Institute during the war and emphasised the good work which had been carried out by the Education Committee whose report was issued in December, 1943. He stated that the education of the young foundrymen must be a matter of concern for every member, and it was hoped at an early date to present a Paper on this subject. He also drew attention to the generous gesture of the President of the Institute, Mr. J. W. Gardom, in making it possible for certain students to attend Technical Council or Sub-Committee meetings, and said that he hoped any young foundryman in the Tyneside area who wished to increase his knowledge would complete the application form without delay.

Mr. Ellis introduced Mr. G. W. Nicholls, a member of the West Riding of Yorkshire Branch, who read his Paper entitled "Moulding Sands and Gases in Relation to Casting Defects," which appeared in the issues of THE FOUNDRY TRADE JOURNAL dated June 1 and June 8 last. This Paper was very well received and a useful discussion followed.

It was evident from the number of requests for nomination papers that the optimism of the Branch Council concerning the future has been more than justified, and there was not the slightest doubt that the Newcastle-upon-Tyne Branch would, as had been previously stated, regain the strength which it had attained before the war.

NEW PATENTS

The following list of Patent Specifications accepted has been taken from the "Official Journal (Patents)." Printed copies of the full Specifications are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. each.

563,448 RUBERY OWEN & COMPANY, LIMITED, and COUPLAND, E. Flash-welding.

563,485 RICHARDSON, P. S., and WILD-BARFIELD ELECTRIC FURNACES, LIMITED. Maintenance of atmosphere in furnaces.

563,526 BAKER & COMPANY, INC. Alloys.

563,562 ASEA ELECTRIC, LIMITED, LONG, T. A., and FITCH, S. Electrode holders for arc-welding.

563,568 E.M.B. COMPANY, LIMITED, SMITH, S., and COCKERILL, W. H. Machines for moulding plastic materials, or for use in making die castings from metal.

563,571 UDDEHOLMS AKTIEBOLAG. Method of increasing the resistance to corrosion in the manufacture of stainless steel.

563,593 DETRICK COMPANY, M. H. Furnace arch or roof construction.

563,608 BRITISH INSULATED CABLES, LIMITED, FULLER, W. P., and LAUDER, J. G. Extrusion presses for lead and lead alloys.

563,611 WOODALL-DUCKHAM (1920), LIMITED, GARDNER, W. T., CLARK, A. N., and WORTH, F. C. Construction of retorts, furnaces, and like apparatus.

563,616 FAIRWEATHER, H. G. C. (National Smelting Company). Aluminium base alloys.

563,754 RIDLEY, F. F., and SCHOLES, W. Separation of solid materials having different specific gravities by means of liquid media.

563,765 ELECTRO METALLURGICAL COMPANY. Austenitic alloy steels.

563,796 WACHTEL, L. Sand-blast nozzles.

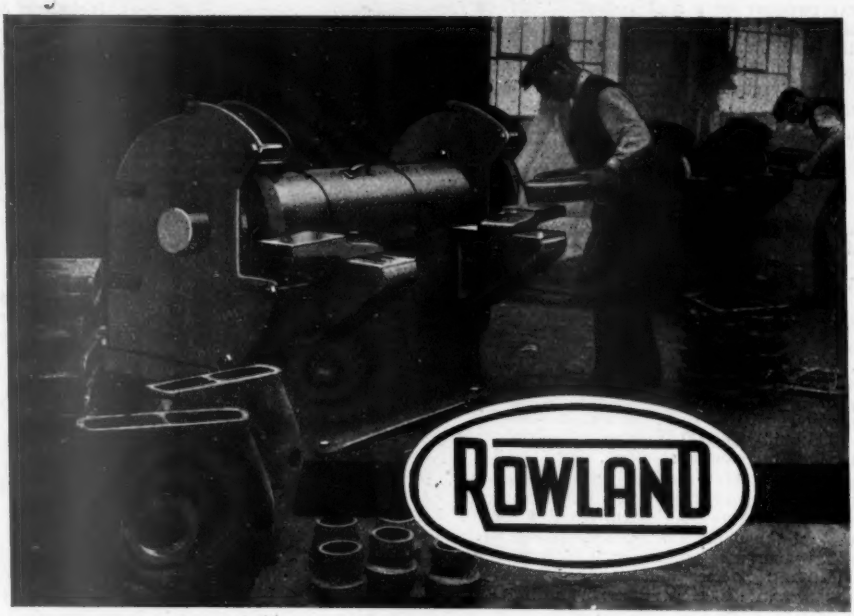
563,809 BROCKHOUSE CASTINGS, LIMITED, and CLEWS, J. Method of and means for manufacturing chains.

563,818 ELLIS, C. C., and WILD-BARFIELD ELECTRIC FURNACES, LIMITED. Apparatus for lifting lids or doors of furnaces and similar lids or doors.

A CENTENARY OF IRON MAKING

The Midland Iron Company, Limited, of Rotherham, celebrated its centenary in the traditional form by holding a dinner in the Town Hall, with the Mayor and Town Clerk as their principal guests. Mr. George Wood, chairman of the company, presided.

As a more permanent souvenir, the company has issued a well illustrated brochure which contains the history of the firm, its manufacturing equipment, and some notes as to the future of wrought iron. Its history has been somewhat chequered, but since it came under the control of Thos. W. Ward, Limited, it has continued to progress, due, no doubt, to modernisation and good management. It is interesting to note that of a total of 288 employees no fewer than 12 have over 50 years' service to their credit.



HIGH SPEED GRINDERS
for High Speed Fettling

● AVAILABLE FOR PROMPT DELIVERY

These Machines are capable of rates of Metal Removal far beyond those possible with Machines fitted with Slow Speed Grinding Wheels, and provide reductions in Production Costs of a very high order.

Available in three sizes with shafts on Ball and Roller Bearings, Range of Speeds, Solid Steel Guards and Modern Dust Extraction Equipment.

Abrasive Cutting-off Machines are available suitable for Foundry Work. Also Heavy Duty Portable or Swing Grinders.

F. E. ROWLAND & CO. LTD. CLIMAX WORKS REDDISH, STOCKPORT

NEWS IN BRIEF

THE ESTABLISHMENT of a staff college for industry was discussed recently by the Birmingham centre of the Institute of Industrial Administration.

SIR ANDREW DUNCAN, Minister of Supply, announced recently that it was proposed to suspend any further collection of iron railings for scrap.

THE DIRECTORS of British Steel Construction (Birmingham), Limited, propose to increase the capital from £100,000 to £200,000 by the creation of 400,000 5s. shares.

A PLEA for an early statement by the Government on how deconcentration of industry is to take place was voiced by Mr. John S. Dodd, M.P., president of the Association of British Chambers of Commerce, at Lincoln. Plans for the reconversion of plants should be carried out immediately so that they could become operative as soon as required.

SPEAKING AT A MEETING at Newcastle-upon-Tyne, Mr. R. S. Hudson, Minister of Agriculture, said that the Admiralty had permitted him to give some information regarding the Tyne's contribution to the war effort. He announced that since the war started, Tyne shipyards had built 500,000 tons of warships and 2,000,000 tons of mercantile shipping.

THE NON-FERROUS METALS CONTROL has decided to withdraw all restrictions on galvanising forthwith. Galvanisers, when making application for licences for zinc in future, should submit schedules listing separately the tonnage of zinc used, or to be used, under the following headings: Sheets; tubes and tube fittings; wire; hollowware; and general galvanising. Other details need not be given.

A MEETING WAS HELD at Newcastle-upon-Tyne on October 6 to pursue further the plan for forming a North-East Development Association to try to stimulate business in the North-East after the war. The promoter of the scheme is Lord Ridley. The Association will be controlled by a Council of members from local authorities, Members of Parliament, industrial firms, and harbour authorities and other bodies.

COURT CONFIRMATION is being sought by Archibald Baird & Son, Limited, Clyde Steel and Engineering Works, Hamilton, of a capital reduction from £100,000 to £75,000. This is to be effected by returning 5s. per share to holders of 85,007 issued £1 shares and by reducing the nominal amount of 14,993 unissued shares from £1 to 15s. each. The capital is to be subsequently restored to £100,000 by the creation of 50,000 new shares of 10s. each.

THE MONMOUTHSHIRE COUNTY COUNCIL, in association with the Newport Borough Council and local industrialists, opened a week's exhibition at the Technical College, Newport, on Saturday last. It is designed to show not only the wide range of the county's products, but also the resources and potentialities of Monmouthshire as a site for new post-war industries and for the expansion of existing undertakings. All the larger firms in Newport and the county are showing examples of their products. The opening ceremony will be performed by the Minister of Reconstruction, Lord Woolton.

THE SHAREHOLDERS of Mirrlees, Bickerton & Day, Limited, have approved the sale of the Diesel-engine business of that company to Associated British Engineering, Limited. The conditional agreement between the companies therefore becomes operative. As soon as the technical details are settled, a new company to be called Mirrlees, Bickerton & Day, Limited, will be formed, and the existing company will change its name to the Mirrlees Watson Company, Limited. The latter will carry on its present business of making sugar machinery and other special equipment.

SIR FRANCIS JOSEPH, president of the Institute of Industrial Administration, addressing a meeting of the Merseyside Centre in Liverpool, said that many people were clamouring for all controls to be removed with the defeat of Germany. He was convinced that both in this country and America controls must continue at least for a time; if they were removed, there would be an unbalanced production which would only add to our difficulties. But the way controls had been exercised during the war made us suspicious about them in the future. A tremendous increase had taken place in the number of people employed by Government departments and special Ministries. The demobilisation of many of those departments was perhaps of greater economic importance than the demobilisation of the Armed Forces.

OBITUARY

MR. C. S. DICKIE, who was for 26 years chief financial officer for Thos. Firth & John Brown, Limited, Sheffield, died recently.

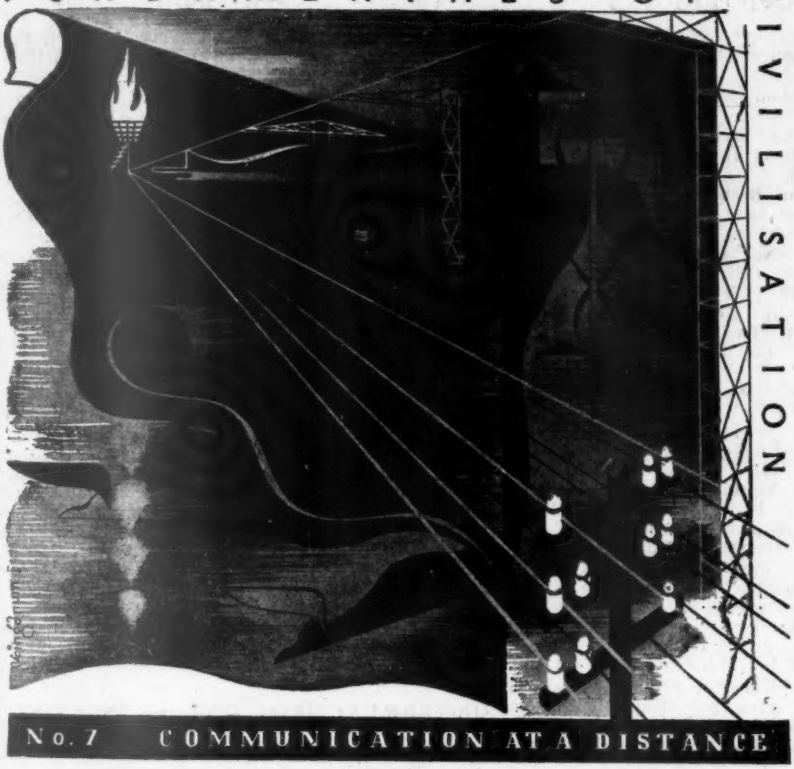
MR. HARRY ALLDAY, managing director of John Betts & Sons, Limited, Charlotte Street, Birmingham, gold and silver smelters and refiners, has died after a short illness. He was 91.

MAJOR H. J. W. MARSH, a director of Marsh Bros. & Company, Limited, steelmakers, Sheffield, has been killed in action in Italy. He was also a director of the Effingham Steel Works, Limited, and Spear & Jackson, Limited.

MR. HENRY MARTIN, of Linthorpe, Middlesbrough, superintendent of the bridge and constructional department of Dorman, Long & Company, Limited, has died at the age of 53. He helped to build the Sydney Harbour bridge as supervisor of the fabricated steelwork.

MR. THOS. R. SHAW, chief draughtsman of the Churchill Machine Tool Company, Limited, died recently. Mr. Shaw, who was in his 72nd year, was associated with the company over a period of 33 years. He was a member of the Institution of Mechanical Engineers and of the Manchester Association of Engineers. He made many valuable contributions to the design and development of machine tools and precision grinding machines in particular, and was the author of several technical publications.

FUNDAMENTALS OF CIVILISATION



THE UNITED STEEL COMPANIES LTD

No. 7 COMMUNICATION AT A DISTANCE

Mercury of ancient mythology was the courier of the gods flying with winged sandals to transmit their will to men.

In the dim past, tribe spoke to tribe by means of smoke signals. Then came the flaring beacons—those flames on Skiddaw which "roused the burghers of Carlisle." In days of dire peril the news of Napoleon was flashed along the coasts by semaphore.

The invention of the telegraph, telephone and radio has quickened communication between the nations of the world.

Civilisation extends through the propagation of experience, information and ideas to far distant lands. A vital part in all these complex methods of communication is played by steel.

THE UNITED STEEL COMPANIES LIMITED

STEEL, PEECH & TOZER, SHEFFIELD
SAMUEL FOX & CO. LTD., SHEFFIELD
UNITED STRIP & BAR MILLS, SHEFFIELD
APPLEBY-FRODINGHAM STEEL CO. LTD., SCUNTHORPE
WORKINGTON IRON & STEEL CO., WORKINGTON
THE SHEFFIELD COAL CO. LTD.
THE ROTHERVALE COLLIERIES, TREETON
UNITED COKE & CHEMICALS CO. LTD.
THOS. BUTLIN & CO., WELLINGBOROUGH

U.S.P. 31

COMPANY RESULTS

(Figures for previous year in brackets)

United Steel Companies—Dividend of 5½%, making 8% (same).

Hale & Hale (Tipton)—Interim dividend on the ordinary shares of 5%.

Murex—Final dividend on the ordinary shares of 10%, and a cash bonus of 2½%, making a total distribution of 20% (same).

Thos. Firth & John Brown—Interim dividend on the ordinary shares of 4½%, free of income-tax, on account of 1944 (same).

Oxley Engineering—Net profit for the year to June 30, 1944, £13,094 (£12,271); dividend of 15% (same); forward, £6,549 (£6,580).

Kitchen & Wade—No cash bonus for the year ended March 31, 1944. Two interims, totalling 25%, have been paid (25% and a bonus of 5%, making 30%).

Villiers Engineering—Profit for the year to July 31, 1944, £69,513 (£69,733); depreciation, £21,000 (£18,300); war damage insurance, £750 (£1,297); tax, £25,969 (£28,750); dividend of 10%, £12,500 (same); forward, £72,012 (£64,318).

Ransome & Marles Bearing Company—Net profit for the year to June 30, after taxation, £123,124 (£122,699); war damage premiums, £8,714 (£12,643); to contingencies, £35,000 (same); final dividend of 11%, making 20% (same); forward, £85,348 (£78,928).

Rawlings Bros.—Profit to March 31 last, £8,408 (£10,069); subsidiary loss written off, £330 (£2,359); net profit, £8,078 (£7,710); preference dividend, £1,314 (same); ordinary dividend of 7½%, £4,605 (same); deferred repairs, £1,000 (nil); forward, £4,257 (£4,348).

Sheffield Forge & Rolling Mills—Net profit for the year to June 30 last, before providing for taxation, £28,776 (£31,735); taxation, £15,102 (£17,803); to general reserve, £5,000 (same); dividend of 1s. 3d. per share, less tax, £7,665 (same); forward, £7,520 (£6,511).

Kay & Company (Engineers)—Net profit for the year ended May 31, 1944, after deferred repairs, taxation, depreciation, etc., £15,350 (£18,816); to employees' bonus fund and provident scheme, £1,000 (same); to general and plant reserve, £6,000 (£9,000); dividend of 12½%, less tax, £6,875 (same); forward, £7,281 (£5,806).

Braithwaite & Company Engineers—Trading profit for the year ended March 31, 1944, £104,457 (£120,442); dividend from Braithwaite & Company (India), £11,921 (£9,440); employees' pension and life funds, £2,993 (£2,520); depreciation, £12,346 (£11,554); interest, £1,903 (£3,206); war damage, £1,110 (£841); deferred repairs, nil (£30,000); income-tax and E.P.T., £77,500 (£64,750); net profit, £20,533 (£17,019); transferred from provision for taxation not now required, £25,000 (nil); reserve for pensions (past service), £15,000 (nil); general reserve, £25,000 (nil); preference dividend, £7,207 (£6,164); ordinary interim dividend of 3%, £4,874 (2½%, £3,245); final dividend of 3½%, £3,812 (same); forward, £22,501 (£33,861).

PERSONAL

MR. E. SHAW, sales manager of the Refractory Brick Company of England, Limited, of Steetley, has been appointed a director of the company.

MR. F. G. COOKE has relinquished his position as foundry metallurgist at High Duty Alloys, Limited, Slough, and has been appointed production metallurgist to Darwins, Limited, FitzWilliam Works, Sheffield.

MR. E. REGAN has resigned his position as foundry manager of International Alloys, Limited, Slough, and is now foundry production engineer, Anti-Attrition Metal Company, Limited, Maidenhead.

SIR SAMUEL TURNER, who has been a director of Turner & Newall, Limited, since the formation of the company in 1920, and its chairman since 1929, resigned the latter office with effect from October 1 last. The board have appointed MR. W. W. E. SHEPHERD, the present deputy chairman, to be chairman as from that date. Sir Samuel, at the special request of his colleagues, has agreed to remain a director of the company for the time being, and to accept appointment as deputy chairman in place of Mr. Shepherd.

MR. W. H. WEBSTER, manager of the spring department of the English Steel Corporation, Limited, Sheffield, is retiring. Mr. Webster went to Vickers, Limited, 25 years ago as assistant manager and installed the necessary plant when the firm took up the manufacture of laminated springs for motor-cars. He became manager two years later. The patent for a plant to mass produce springs by mechanical means, bending and hardening being done in one operation, was taken out jointly in the name of Mr. Webster and the firm. Mr. Webster will continue to serve the firm in a consultative capacity.

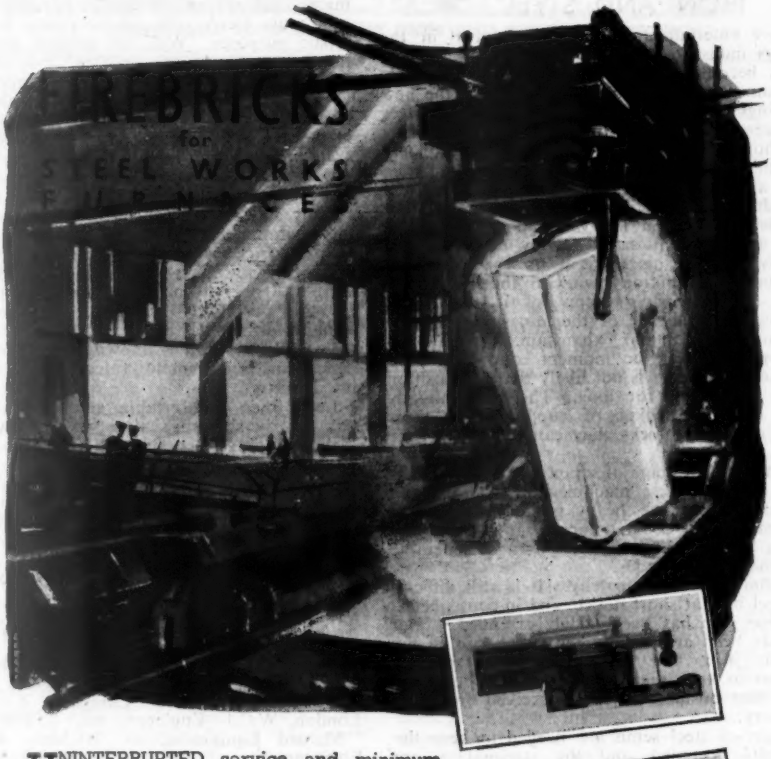
INTERIM SCHEME FOR UNEMPLOYED

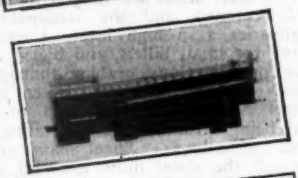
The Unemployment Insurance (Increase of Benefits) Bill, introduced in the House of Commons by Mr. Bevin, which proposes to increase benefit rates by amounts of from one to six shillings a week, is an interim measure to cover the period which must elapse before the new social insurance scheme can be introduced, and the period of the transition from war to peace production. The new rates will apply from a date to be fixed by Order by the Minister, and they will not be accompanied by any increase in the contributions payable.

The benefit rates under the general scheme will be increased by 4s. to 24s. a week for men and 22s. a week for single women and by 2s. to 20s. a week for married women. The rates for young men and women between 18 and 21 are raised by 3s. to 19s. and 17s. a week respectively, and the rates for boys and girls of 17 are raised by a similar amount to 12s. and 10s. 6d. a week respectively. Boys and girls of 16 will receive 1s. more to bring their rates to 7s. and 6s. a week.

This increase of benefits will throw no extra charge upon the Exchequer except for the sums payable in respect of persons discharged from the Forces.

LONG LIFE · RELIABILITY





UNINTERRUPTED service and minimum maintenance costs are assured by the use of firebricks selected to meet the operational requirements of particular furnaces. The **GLENBOIG** sales staff are at the service of users of firebricks to assist them in the selection of materials.

GLENBOIG

THE GLENBOIG UNION FIRE CLAY CO. LTD.
48, WEST REGENT STREET, GLASGOW C.2

GENERAL REFRACTORIES LIMITED,
GENEFAX HOUSE, SHEFFIELD 10

87

Raw Material Markets

IRON AND STEEL

Hopes are entertained of an early revival in the light-castings industry. The need for homes for the people has become so pressing that both the repair of bomb damaged houses and the erection of the new steel dwellings may not be delayed a moment longer than is necessary. Orders for domestic fittings may therefore shortly be increased. This would immediately react on the demand for pig-iron, which meanwhile is only on a limited scale. Even the engineering and allied foundries are short of work, and current output of all grades of iron—in low- as well as high-phosphorus—is ample for all needs. Only hematite is in short supply, and of this there is no early prospect of more liberal distribution owing to the scarcity of suitable ores. Cleveland's output of ironstone has been reduced, and the life of the mines in this area is approaching the point of exhaustion.

Coke supplies are at the moment coming forward quite satisfactorily, but it is not likely that the position will remain favourable for long. There are already indications of a tightening of supplies, and users are taking in all the stocks they can while the coke is available.

There is now no shortage of scrap. Although short heavy-steel and first-class machinery metal still find a good market, only the heavy grades of ordinary cast-iron scrap are in demand for the foundries. All requirements are covered, and there is a considerable surplus of the lighter grades.

Trade in finished iron is patchy. It is still difficult to obtain steel bars at short notice, and in consequence the use of bar iron has been widely extended. But this trend has been arrested by the sharp rise in the price of bar iron, and makers are now securing further orders to keep their plant in regular employment. The best business is being received from the wagon industry.

Big tonnages of steel semis are needed to keep the re-rollers fully occupied, and the steelmakers are maintaining deliveries at a high level. Users, however, are pressing for small billets, and bigger outputs would be welcome. Considerable tonnages of defectives, crops, etc., are also being taken up, but shell-discard steel is less easily disposed of, much of this material being unsuitable for re-rolling owing to the presence of alloys. Sheet bars are also abundant, although the sheet mills are still turning out substantial tonnages of black and painted sheets, mainly for military purposes.

Bookings for steel plates, heavy joists and sections tend to shrink, but there is still a healthy demand for light structural sections, and special sizes. Demand for special steels is also inclined to drop, but wire drawers have as much work as they can handle, and the mining industry has already placed substantial orders for roofing bars, arches, props, etc., for the fourth period.

NON-FERROUS METALS

During recent weeks there have been definite steps towards a more generous allocation of non-ferrous metals for urgent civilian requirements. Copper is now more freely released for piping for building and repair purposes. With the present easy supply position of copper in this country, it is probable that in the near future an increasing tonnage of metal will be made available. At this stage of the war it is extremely unlikely that there will be any large revival in the demand for copper for munitions production.

In the case of tin, unlike that of the other non-ferrous metals, there have been no suggestions of removing the restrictions on its use. There is not likely to be any marked change in the allocation policy until the liberation of the Asian tin-producing areas.

All restrictions on galvanising have now been withdrawn by the Non-ferrous Metals Control. So far there had only been limited amounts of zinc released for this purpose. During the past few months the demand for zinc has been steadily diminishing, although the supply position is known to be satisfactory. This concession is extremely welcome to the zinc-producing industry.

Lead is in comfortable supply, and consumption has latterly showed signs of falling off. The busiest section is the battery trade. No allocations are being made for non-priority purposes, but one of the reasons may be that imports of lead are being kept down as far as possible in the interests of conservation of shipping space. Freer use of lead piping for housing construction and repair is, however, now permitted.

NEW COMPANIES

("Limited" is understood. Figures indicate capital. Names are of directors unless otherwise stated. Information compiled by Jordan & Sons, 116, Chancery Lane, London, W.C.2.)

Longden Foundry Company, Folly Hall, Huddersfield—£2,000. G. and G. A. Longden.

Wilmot Mansour & Company, 4-5, Staple Inn, London, W.C.1—Engineers, etc. £5,000.

Macard Equipment, 69, Wetherby Road, York—Engineers, etc. £1,000. E. and V. Elliott.

Strongarc Welding Company, 283, Boulevard, Hull—£2,500. G. M. A. Gillam and H. Everington.

C. A. Foyster (Engineers)—£2,000. C. A. Foyster, Metheringham, Lincoln, and J. E. Thompson.

John McColville & Sons, 31, Queen Street, Cardiff—Engineers, etc. £20,000. J. & J. C. McColville.

Stordy Engineering, Midland Chambers, Princes Street, Wolverhampton—£3,000. J. S. and I. C. Stordy.

A. & C. Sears (Engineering), Lynford House, Manea, Cambs—£1,000. A. C., C. N., and D. W. Hawes.

Adcott Engineering Company, Lodge Road, Addington, Middlesex—£500. R. B. and P. E. Addison.

Henderson & Whittaker—Manufacturers of aluminium castings, etc. £1,000. C. E. Doldon and T. H. Downs.